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Student Article

Association between menstrual disturbances and habitual use of caffeine

Asmaa Zki Bin Mahmoud*, Alaa Naeem Makhdoom, Lujain Alaaldeen Mufti, Rasha Salem Alreheli, Rawan Ghazi Farghal and Sarah Ehab Aljaouni

College of Medicine, Taibah University, Almadinah Almunawwarah, Kingdom of Saudi Arabia

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الملخص

أهداف البحث: تهدف هذه الدراسة إلى تحديد علاقة شرب المشروبات المحتوية على الكافيين بالحيض بين الطالبات السعوديات.

طرق البحث: أُجريت هذه الدراسة المقطعية خلال العام الأكاديمي ٢٠١١م، عن طريق توزيع استبانة ذاتية متعلقة بالحيض والاستخدام المعتاد للأطعمة أوالمشروبات المحتوية على الكافيين، شملت ٣٥٠ سيدة قبل انقطاع الحيض من منسوبات الجامعة اللاتي لا يعانين من أمراض طبية. تم حساب معدل الاحتمالات ونطاق الثقة ٩٥٪ بواسطة جدولة معدل التربيع كاي. واعتبرت جميع التحليلات ذات قيمة دلالية إذا كانت قيمة P أكبر من ٠٥٠.

النتائج: **تعاني** ١٤٠ سيدة (٤٠٪) من العينة من اضطرابات في الدورة الشهرية, و ٢٦٪ من انقطاع الحيض, و ٢٠.٩٪ من ندرة الحيض, و ١٣. ٤٪ من غزارة الدورة, و ٩.٧٪ من طول مدة الدورة. كما ذكر عدد قليل (٧.٧٪) من السيدات أن لديهن تشخيص سابق لمرض المبيض المتعدد الكيسات. ووجد أن القهوة عامل خطورة لكلا من طول مدة الدورة وندرة الحيض. كما وجد أن النسكافيه عامل خطورة لغزارة الدورة وأعراض الحيض. ووجد أن الشوكولاتة تحمي من أعراض متلازمة ما قبل الحيض.

الاستنتاجات: هناك ارتفاع معدل اضطرابات الحيض غير المشخصة بين السيدات السعوديات في الجامعة. والاستخدام المعتاد للكافيين يجب اعتباره عامل خطورة لمعظم اضطرابات الحيض.

الكلمات المفتاحية: المشروبات المحتوية على الكافيين; عدم انتظام الحيض; مبيض متعدد الكيسات; متلازمة ما قبل الحيض

Abstract

Objectives: The main objective of this study was to determine whether there is an association between drinking caffeinated beverages and menstruation among Saudi female students.

Methods: During the 2011 academic year, a cross-sectional study was conducted by administering a questionnaire about menstruation and self-reported habitual use of caffeinated food or drinks to 350 premenopausal women with no known medical disease who were working or studying at the University. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated by chi-squared cross-tabulation. All tests were two tailed, and results were considered significant when $p < 0.05$.

Results: Irregular periods were reported by 140 women (40%), amenorrhoea by 26%, oligomenorrhoea by 20.9%, heavy periods by 13.4% and prolonged periods by 9.7%. Few women (7.7%) reported a previous diagnosis of polycystic ovary disease. Coffee was a risk factor for both prolonged periods (OR, 2.37; 95% CI, 1.09–5.12; $p = 0.03$) and oligomenorrhoea (1.95; 1.15–3.30; $p = 0.014$). Nescafe was a risk factor for heavy periods (2.22; 1.91–4.12; $p = 0.011$) and menstrual symptoms (1.84; 1.06–3.02; $p = 0.039$). Chocolate was protective against premenstrual symptoms (0.22; 0.06–0.85; $p = 0.049$).

Conclusions: There is a high prevalence of undiagnosed menstrual disturbances among Saudi university women. Habitual use of caffeine should be considered a risk factor for most menstrual abnormalities.

* Corresponding address: Medical Students at the College of Medicine, Taibah University, Almadinah Almunawwarah, Kingdom of Saudi Arabia.

E-mail: asmaazki90@hotmail.com, fullah_zak@hotmail.com (A.Z. Bin Mahmoud)

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Keywords: Caffeinated drink; Irregular menstruation; Polycystic ovary; Premenstrual syndrome

Introduction

Caffeine is one of the most commonly ingested pharmacologically active substances. It is present in coffee, tea, soft drinks, cocoa, solid milk chocolate and many medications. Caffeine is rapidly absorbed from the digestive tract and distributed throughout the tissues. The mechanisms of action of caffeine include inhibition of hydrolysis of cyclic 3′,5′-adenosine monophosphate and 3′,5′-guanosine monophosphate[1] and antagonism of adenosine.[2] Therefore, caffeine may alter hormone profiles and thus affect menstrual function. Menstrual dysfunction, in turn, may be related to other health outcomes, such as fertility, osteoporosis and breast cancer.[3]

The results of studies of coffee and caffeinated beverage consumption in relation to fertility are inconsistent. Several studies have reported deleterious effects,[4–6] while others have shown either no association,[7] a relation only at very high levels of intake[8] or even improved fertility.[9] One study[10] concluded that soft drinks may be a risk factor for infertility, irrespective of their caffeine content. A possible explanation for this inconsistency is that most of the studies were retrospective and thus subject to recall and other types of bias. Although clear pathophysiological mechanisms for the presumed effects of caffeine on fertility have not been elucidated, it has been suggested to affect ovulation. In contrast, caffeine has been linked to greater sensitivity to insulin,[11] which in turn has been related to improved ovulatory function in women with polycystic ovary disease,[12] which is the commonest cause of anovulation in women of reproductive age and the commonest cause of infertility due to ovulation disorders.[13–14] No studies have been performed on Saudi women, who are high consumers of caffeinated drinks, especially Arabic coffee.

The aim of this study was to investigate whether there is an association between menstrual abnormalities and caffeine consumption among premenopausal Saudi women at Taibah University.

Material and Methods

This cross-sectional study was conducted by third-year female medical students during the 2011 academic year at Taibah University, Almadinah Almunawwarah, Kingdom of Saudi Arabia after approval from the authorities at the College of Medicine and as part of their research methodology course. An online calculation was used to estimate a sample size of 384 for a confidence interval (CI) of 95% and a margin of error of 5%. We therefore prepared 384 pre-coded, well-constructed questionnaires and placed them at the reception of the infirmary. The receptionists handed the questionnaire randomly to 384 women aged 17–45 years who were working or studying at the University and attending the infirmary for various causes and asked them to answer the questions carefully, after obtaining their verbal consent to participate. The questionnaires were collected at the end of the day by the researchers for revision and data entry. Of the 384 questionnaires, 34 were excluded because of incomplete data or exclusion criteria (currently pregnant; smoker; using oral contraceptives, an intrauterine device or hormonal medications; taking medications containing caffeine; history of hysterectomy, hypothyroidism or any gynaecological disease except polycystic ovarian disease). The questionnaire elicited information about educational level, marital status, premenstrual syndrome, amount of bleeding (average, heavy or scanty) and the regularity and duration of periods.

Irregular periods were defined as any type of abnormal bleeding, including late or early period, bleeding between periods, missed periods, continuous periods or periods occurring twice in one cycle. Any period that lasted for more than 8 days was considered to be long, and one that occurred every 24 days or fewer was considered to be short. Amenorrhoea was defined as the absence of menses for 3 months in a woman with previously normal menstruation or 9 months in a woman with a history of oligomenorrhoea. One question asked about diagnoses of polycystic ovarian disease, and others asked about usual daily consumption of the caffeinated beverages coffee, tea, Nescafe, carbonated soft drinks, chocolate and hot chocolate, in number of cups or cans per day.

Statistical analysis

All data were managed and analysed with SPSS software for Windows version 17. Prevalence was calculated as percentages (frequency), and odds ratios (ORs) were calculated with their 95% CIs by chi-squared cross-tabulation. All tests were two-tailed, and results were considered significant when $p < 0.05$.

Results

Most women (76%) were aged 17–25 years, had a bachelor's degree (82.9%) and were single (63.4%) (Table 1). Regular menstruation was reported by 60%, an average duration (3–7 days) by 87.7% and an average volume by 81.7%. The prevalence of premenstrual symptoms (68.6%) exceeded that of menstrual symptoms (18%). Irregular periods were reported by 40%, with amenorrhoea in 26%, oligomenorrhoea in 20.9%, heavy periods in 13.4% and prolonged periods in 9.7%. Few women reported a previous diagnosis of polycystic ovarian disease (7.7%) (Table 2).

The commonest source of caffeine use was chocolate (66.6%). More than half the women drank coffee (52%), with 32.9% drinking Arabian coffee; followed by tea (48.9%), with 36.3% drinking red tea; then carbonated soft drinks (41.6%), with 31.1% drinking Pepsi Cola; and lastly Nescafe (34.6%), with 17.4% drinking cappuccino and 11.1% drinking Coffee-Mate®. Most women did not exceed two cups of any drink daily (46.6% for coffee, 43.7% for tea, 20.6% for Nescafe, 45.1% for soft drinks and 28% for hot chocolate). Only a few consumed large amounts (>5 cups or cans daily) of coffee (9.4%), tea (2.3%), soft drinks (1.7%) or hot chocolate (0.3%) (Table 3).

Table 1: Characteristics of participants.

Characteristic	No. (%)
Age (years)	
17–25	266 (76%)
25–35	52 (14.9%)
35–45	30 (8.6%)
Education	
None	0.3%
Primary school	0%
Secondary school	8.9%
Bachelor degree	82.9%
Other	6.6%
Marital status	
Single	63.4%
Married	19.7%
Divorced	1.4%
Widowed	13.4%
Separated	1.1%

Coffee was a risk factor for both prolonged periods (OR, 2.37; 95% CI, 1.09–5.12; $p = 0.03$) and oligomenorrhoea (1.95; 1.15–3.30; $p = 0.014$); and Nescafe was a risk factor for heavy periods (2.22; 1.91–4.12; $p = 0.011$) and menstrual symptoms (1.84; 1.06–3.02; $p = 0.039$). Chocolate was protective against premenstrual symptoms (0.22; 0.06–0.85; $p = 0.049$) (Table 4). No significant risk seen with drinking tea or carbonated soft drinks (data not shown).

Discussion

Women who consumed caffeine were more likely to have menstrual abnormalities, mainly prolonged and heavy menses, as well as oligomenorrhoea. The association with prolonged or heavy menstruation is biologically unreasonable, as caffeine is a known vasoconstrictor[15] and would be expected to reduce uterine blood flow, which would reduce menstrual bleeding and shorten the duration of menses. Research in pregnant animals[16] and humans[17] indicates that caffeine increases uterine vascular resistance and reduces uterine blood flow. The mechanism by which caffeine alters the duration of the menstrual cycle is not clear, but it could occur via an effect on sex hormones or hormone receptors. Kitts[18] found that constituents of coffee are weakly oestrogenic. Caffeine inhibits the action of adenosine, which in laboratory studies affects luteinizing hormone and follicle-stimulating hormone,[19,20] which could in turn affect the length of the menstrual cycle. Gilbert and Rice[21] found depressed oestrogen levels in female monkeys at a dose of caffeine associated with miscarriages, stillbirths and decreased maternal weight gain. Associations were found between caffeine intake and oestradiol and/or oestrone levels in some studies[22,23] but not in others.[24] Cooper et al.[24] found no notable relation between caffeine intake and cycle length, variability or menses length. Other researchers[4] found no indication that caffeine intake is related to an increased risk for anovulation.

The difference between our results and those of others could be due to the presence of confounding factors, as 66.6% of our participants habitually used non-caffeinated beverages. Methodological differences might also explain the differences in results. In most other studies, data was not collected on all drinks, food and drugs containing caffeine, while we had information on all foods and excluded all medications containing caffeine in order to minimize their contribution to total caffeine intake. Still, potential exposure misclassification might have affected our estimates of

Table 2: Characteristics of menstrual periods of participants.

Variable	No. (%)
Regularity	
Regular	210 (60%)
Irregular	140 (40 %)
Duration (days)	
<3	7 (2.0%)
3–7	307 (87.7%)
>7	34 (9.7%)
Volume	
Moderate	286 (81.7%)
Heavy	47 (13.4%)
Light	17 (4.9%)
Symptoms	63 (18%)
Premenstrual syndrome	240 (68.6%)
Amenorrhoea	91 (26.0%)
Oligomenorrhoea	73 (20.9%)
History of polycystic ovary disease	27 (7.7%)

Table 3: Use of caffeine-containing beverages by participating women.

Caffeinated food or drink	No. (%)	Amount: No. (%)
Coffee	182 (52%)	1–2 cups: 163 (46.6%) 3–5 cups: 44 (12.6%) >5 cups: 33 (9.4%)
Nescafe	121 (34.6%)	1–2 cups: 72 (20.6%) 3–5 cups: 2 (0.5%) >5 cups: 0%
Tea	171 (48.9%)	1–2 cups: 153 (43.7 %) 3–5 cups: 44 (12.6%) >5 cups: 8 (2.3%)
Carbonated soft drink	146 (41.6%)	1–2 cans: 123 (35.1%) 3–5 cans: 17 (4.9%) >5 cans: 6 (1.7%)
Chocolate	233 (66.6%)	One piece: 109 (31.1)% Whole bar: 67 (19.1%) >bar: 29 (8.3%)
Hot chocolate	105 (30%)	1–2 cups: 98 (28%) 3–5 cups: 6 (1.7%) >5 cups: 1 (0.3%)

Table 4: Significant odds ratios (ORs) for menstrual abnormalities associated with use of caffeine-containing products.

Product	Abnormality or symptoms	OR	95% CI	*p*
Coffee	Prolonged periods	2.37	1.09–5.12	0.03
	Oligomenorrhoea	1.95	1.15–3.30	0.014
Nescafe	Heavy periods	2.22	1.91–4.12	0.011
	Menstrual symptoms	1.84	1.06–3.02	0.039
Chocolate	Premenstrual symptoms	0.2	0.05–0.90	0.021

caffeine intake. We estimated caffeine dose from a self-administered questionnaire, and there may be substantial variation in caffeine content according to serving size, brand, ingredients, method of beverage preparation and brewing time.[25,26] Another limitation of our study is its cross-sectional design, which provides limited capacity to establish causal relations.

Conclusions

Our study shows that caffeine consumption is related to prolonged, heavy menses and oligomenorrhoea. Non-caffeinated drinks, soft drinks and chocolate were not associated with abnormal menstruation, and chocolate was associated with fewer premenstrual symptoms. These findings could have implications for women's long-term health.

We also found a high prevalence of undiagnosed menstrual disturbances among Saudi university women. Habitual use of caffeine-containing products, apart from chocolate, should be considered a risk factor for most menstrual abnormalities. Clinical trials should be performed to confirm these findings and to examine subsequent health outcomes in women.

Authors' contributions

All the authors, in association with Zainab Ahmed, constructed, distributed and collected the questionnaires and analysed the data. They wrote the manuscript under the supervision of Dr Intesar Sultan.

Conflict of interest

The authors have no conflict of interest to declare.

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